

**IN THE CLAIMS:**

Please amend the claims as indicated below.

- 1 1. (Amended) A method for improving the physical and mechanical properties of ion-  
2 conducting materials, comprising:  
3 providing an ion conducting base material;  
4 providing a crosslinking agent; and  
5 incorporating the crosslinking agent into the ion-conducting base material through  
6 hydroxyl and sulfonic acid condensation or ~~though~~ through amine and sulfonic acid  
7 condensation.
- 1 2. (Previously Presented) A method as in claim 1, wherein the incorporation takes place in a  
2 non-aqueous environment.
- 1 3. (Previously Presented) A method as in claim 1, wherein the crosslinking agent has a  
2 chain that includes an aromatic polymer chain, an aliphatic polymer chain, an organic or  
3 inorganic polymer network, or any combination thereof.
- 1 4. (Previously Presented) A method as in claim 1, wherein, in addition to one or more of  
2 amine, hydroxyl, or sulfonic acid groups, the crosslinking agent has at least one functional group  
3 to form a covalent crosslinking bond with the ion conducting base material.
- 1 5. (Previously Presented) A method as in claim 1, wherein the ion conducting base material  
2 is an organically-based material, an inorganically-based material, or a composition thereof.
- 1 6. (Previously Presented) A method as in claim 1, wherein the ion conducting base material  
2 is organically based and containing aromatic or aliphatic structure.
- 1 7. (Previously Presented) A method as in claim 6, wherein the aromatic structure includes  
2 poly-aryl ether ketones and poly-aryl sulfones.

1 8. (Previously Presented) A method as in claim 6, wherein the aliphatic structure includes  
2 perflourinated or styrene co-polymer types

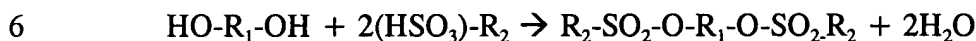
1 9. (Previously Presented) A method as in claim 1, wherein the ion conducting base material  
2 contains one or more inorganic additives.

1 10. (Previously Presented) A method as in claim 9, wherein the inorganic additive is  
2 selected from the group consisting of clay, zeolite, hydrous oxide, and inorganic salt.

1 11. (Previously Presented) A method as in claim 10, wherein the clay includes an  
2 aluminosilicate-based exchange material selected from the group consisting of montmorillonite,  
3 kaolinite, vermiculite, smectite, hectorite, mica, bentonite, nontronite, beidellite, volkonskoite,  
4 saponite, magadite, kenyaite, zeolite, alumina, rutile.

1 12. (Previously Presented) A method as in claim 1, wherein the ion conducting base material  
2 has a given molecular weight and/or polymer structures with functional groups that include  
3 sulfonic acids, phosphoric acids, carboxylic acids, imidazoles, amines, and amides.

1 13. (Previously Presented) A method as in claim 1, wherein the crosslinking agent is  
2 hydroxyl terminated and the ion conducting base material is sulfonated, and wherein the  
3 incorporation includes direct covalent crosslinking between the hydroxyl terminated  
4 crosslinking agent and the sulfonated ion-conducting base material such that their reaction is in  
5 the form of

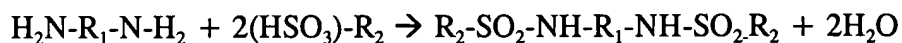


7 where R<sub>1</sub> is the hydroxyl terminated crosslinking agent's main chain and R<sub>2</sub> is the sulfonated  
8 ion conducting base material.

1 14. (Previously Presented) A method as in claim 13, wherein the main chain includes one or  
2 more chains selected from a group consisting of an aromatic polymer chain, an aliphatic  
3 polymer chain, organic molecules and inorganic molecules.

1 15. (Previously Presented) A method as in claim 13, wherein the sulfonated ion conducting  
2 base material includes, one or more chains selected from a group consisting of an aromatic  
3 polymer chain, an aliphatic polymer chain, organic molecules and inorganic molecules.

1 16. (Previously Presented) A method as in claim 1, wherein the crosslinking agent is amine  
2 terminated and the ion conducting base material is sulfonated, and wherein the incorporation  
3 includes direct covalent crosslinking between the amine terminated crosslinking agent and the  
4 sulfonated ion-conducting base material such that their reaction is in the form of

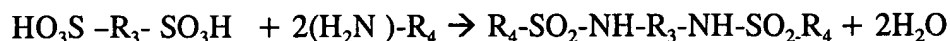


6 where  $\text{R}_1$  is the amine terminated crosslinking agent's main chain and  $\text{R}_2$  is the sulfonated ion  
7 conducting base material.

1 17. (Previously Presented) A method as in claim 1, wherein the crosslinking agent is sulfonic  
2 acid terminated and the ion conducting base material is amine or hydroxyl terminated, and  
3 wherein the incorporation includes direct covalent crosslinking between the sulfonic acid  
4 terminated crosslinking agent and the amine or hydroxyl terminated base ion-conducting  
5 material such that their reaction is in the respective form of



7 or



9 where  $\text{R}_3$  is the sulfonic acid terminated crosslinking agent's main and  $\text{R}_4$  is the amine or  
10 hydroxyl terminated ion conducting base.

1 18. (Previously Presented) A method as in claim 1, wherein incorporation involves a  
2 reaction solvent, including a high boiling point, non-polar solvent selected from a group  
3 consisting of dimethyl sulfoxide (DMSO), n-methyl pyrrolidinone (NMP), dimethyl acetamide  
4 (DMAC) and dimethylformamide (DMF).

1 19. (Previously Presented) A method as in claim 1, wherein incorporation proceeds under

2 azeotropic distillation via a removal of water by toluene to facilitate reaction kinetics.

1 20. (Previously Presented) A method as in claim 1, wherein incorporation involves 0.1 % to  
2 8% crosslinking agent's molar equivalents with respect to ion conducting base material's  
3 sulfonic acid sites.

1 21. (Previously Presented) A method as in claim 1, wherein incorporation involves 0.1 % to  
2 8% crosslinking agent's molar equivalents with respect to ion conducting base material's amine  
3 or hydroxyl group sites.

1 22. (Previously Presented) A method as in claim 1, wherein the ion conducting base  
2 material contains an inorganic cation exchange material.

1 23. (Previously Presented) A method as in claim 22, wherein the inorganic cation exchange  
2 material is selected from a group consisting of clay, zeolite, hydrous oxide, and inorganic salt.

1 24. (Previously Presented) A method as in claim 22, wherein the inorganic cation exchange  
2 material further includes a silica based material and a proton conducting polymer based  
3 material.

1 25. (Amended) A method for adding functionality to ion-conducting materials,  
2 comprising  
3 providing an ion conducting based material;  
4 providing a [modified] crosslinking agent; and  
5 incorporating the modified crosslinking agent into the ion-conducting base material  
6 through hydroxyl and sulfonic acid condensation or ~~though~~ through amine and sulfonic acid  
7 condensation.